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LATE HOLOCENE SONORAN DESERT ARTHROPOD REMAINS FROM A PACKRAT MIDDEN, CATAVIÑA, BAJA CALIFORNIA NORTÉ, MÉXICO

WILLIAM H. CLARK[1] AND JULIA T. SANKEY[2]

[1]Orma J. Smith Museum of Natural History, Albertson College of Idaho, Caldwell, Idaho 83605 e-mail: bclark@acofi.edu and
Museo de Entomología Departamento de Ecologia,
Centro de Investigación Científica y de Educación Superior de Ensenada,
Apartado Postal 2732, 22830 Ensenada, Baja California, México
[2]Royal Tyrrell Museum of Paleontology, Box 7500,
Drumheller, Alberta T0JOYO Canada
e-mail: jsankey@unix1.sncc.lsu.edu

Abstract.—Arthropods are reported for the first time from a late Holocene-aged (1770 ± 60 radiocarbon years B.P.) packrat (*Neotoma*) midden located in a granite boulder field in the Cataviña region of the Central Desert, Baja California, México. More than 23 arthropod taxa have been identified from 315 fragments found in a subsample of the midden. Ten of these taxa have not previously been reported from *Neotoma* midden assemblages. Coleoptera (beetles) and Hymenoptera, Formicidae (ants) are the dominant forms recovered, possibly reflecting a taphonomic bias. We compared the taxa found in the midden assemblage with that found at the site today and found little difference, however a study of the midden plants has revealed that the modern vegetation and climate are drier than ~1770 years ago.

Key Words.—Insecta *Neotoma* (packrat) midden, Central Desert, Baja California, Mexico, Holocene, arthropods, beetles, ants.

Resumen.—Se reportan por primera vez artrópodos provenientes de un depósito de *Neotoma* del Holoceno tardío (1770 ± 60 años de antigüedad, fechado por C^{14}) localizado en un área de rocas graníticas en la región de Cataviña, en el Desierto Central de Baja California, México. Se identificaron más de 23 taxa de artrópodos de 315 fragmentos encontrados en una submuestra del depósito. Diez de estos taxa no habían sido reportados previamente para los depósitos de *Neotoma.* Las formas dominantes recuperadas fueron Coleoptera (escarabajos) e Hymenoptera (hormigas, Familia Formicidae), posiblemente reflejando un sesgo tafonómico. Comparamos los taxa encontrados en el depósito con los que se encuentran actualmente en el sitio y hallamos poca diferencia, sin embargo un estudio de las plantas del depósito reveló que la vegetación y el clima modernos son más secos que hace ~1770 años.

Fossil arthropods have received recent attention (Carpenter 1992a, b; Buckland & Coope 1991) especially from packrat (*Neotoma* spp.) middens (Ashworth 1973, 1976; Elias 1987, 1990, 1994; Elias & Van Devender 1990; Elias et al. 1992; Hall et al. 1988, 1989, 1990; Hebda et al. 1990; Morgan et al. 1983; Spilman 1976; Van Devender & Hall 1994). The objectives of this paper are to describe the arthropod assemblage from a midden and to compare it with that presently found in the area. *Neotoma* fecal pellets in this midden have been dated at 1770 ± 60 radiocarbon years B.P. Only two other packrat (*Neotoma*) middens have been reported in the literature from the peninsula of Baja California, México. The first is located near San Fernando and was discovered by Philip Wells (Axelrod 1979a, b; Van Devender et al. 1987; Wells 1969, 1976). These reports mention only two plants (*Juniperus* and *Prunus*) and three radiocarbon dates of the midden (10,000 years BP). The second midden was collected by a College of Idaho field

expedition during January 1984 to the Cataviña study site (Wells 1986). The midden contained *Juniperus*, and was radiocarbon dated at nearly 18,000 years BP. No detailed description of the middens are given and no mention of arthropods were reported in these publications. The present study expands this base of information and documents the first arthropods from a packrat midden in the peninsula of Baja California, México.

The packrat currently inhabiting the Cataviña area is *Neotoma lepida* Thomas (Huey 1964, Hall 1981). We have live-trapped numerous *N. lepida* at this study site.

There are a variety of reasons arthropods occur in packrat nests/dens: 1) seasonal inhabitants; 2) transported in on plants; 3) incidental visitors; and 4) those that are peculiar to the site (Davis 1934). Aalbu & Andrews (1992) have shown that at least one species of beetle feeds on *Neotoma* pellets. It may be difficult to determine exactly how some arthropods ended up in the midden but regardless the samples make a good datable record of past species and conditions (Van Devender & Hall 1994). We compared taxonomic groups found in the midden with those reported from stored food products (Olsen et al. 1996) because there may be similarities in the microhabitats of the two.

Many other *Neotoma* middens have been found at the Cataviña site, including several from the same boulder area. We report here the results of examination of the youngest midden found to date.

Materials and Methods

Location and Habitat.—This midden is located 9 km northwest of Rancho Santa Inés, Baja California, México (Lat. 29°46′ N, Long. 114°46′ W, elevation 550 m). It is a mid-peninsular locality of the Central Desert in the Cataviña region (Bratz 1976) (Figs. 1 and 2). The area is characterized by the shrubs *Larrea tridentata* (Sessé and Mociño ex Décandolle) Coville, *Ambrosia dumosa* (A. Gray) Payne and *Ambrosia chenopodifolia* (Bentham) Payne, and by the cacti *Opuntia cholla* Weber, *Opuntia molesta* Brandegee, *Pachycereus pringlei* (S. Watson) Britton and Rose, *Lophocereus schottii* (Engelm.) Britton and Rose, *Ferocactus gracilis* Gates, and the boojum, *Fouquieria columnaris* Kellogg (Blom & Clark 1984). The cholla cactus *Opuntia ganderi* Rebman & Pinkava is common at the site (Rebman 1995). Mesquite, *Prosopis glandulosa* Torrey var. *torreyana* (L. Benson) M. C. Johnston is found in the Central Desert (Wiggins 1980) and at the site and is the dominant plant found in this midden (Sankey et al., unpublished data).

The mean annual precipitation for the Cataviña area is about 96 mm (3.8 in) with a mean annual temperature of 18.4° C (n = 14 years, 1956–1967) (Hastings 1964, Hastings & Humphrey 1969). Using 24 years of additional data, García (1981) reports the mean annual precipitation for the area as 101.7 mm (4 in) and temperature 19.0° C. Fifty percent of the precipitation occurs in the three winter months (Dec–Feb) and about another thirty percent of the precipitation occurs during the fall (Sep–Nov) (García 1981). Spring and summer receive little precipitation. Blom & Clark (1984) reported 46 mm of precipitation at the site from 9 Jul 1981 through 4 Jan 1982.

Precipitation measured at the site since that time appears to be less than that reported by García (1981) except for the 1990–1991 winter season (Clark, un-

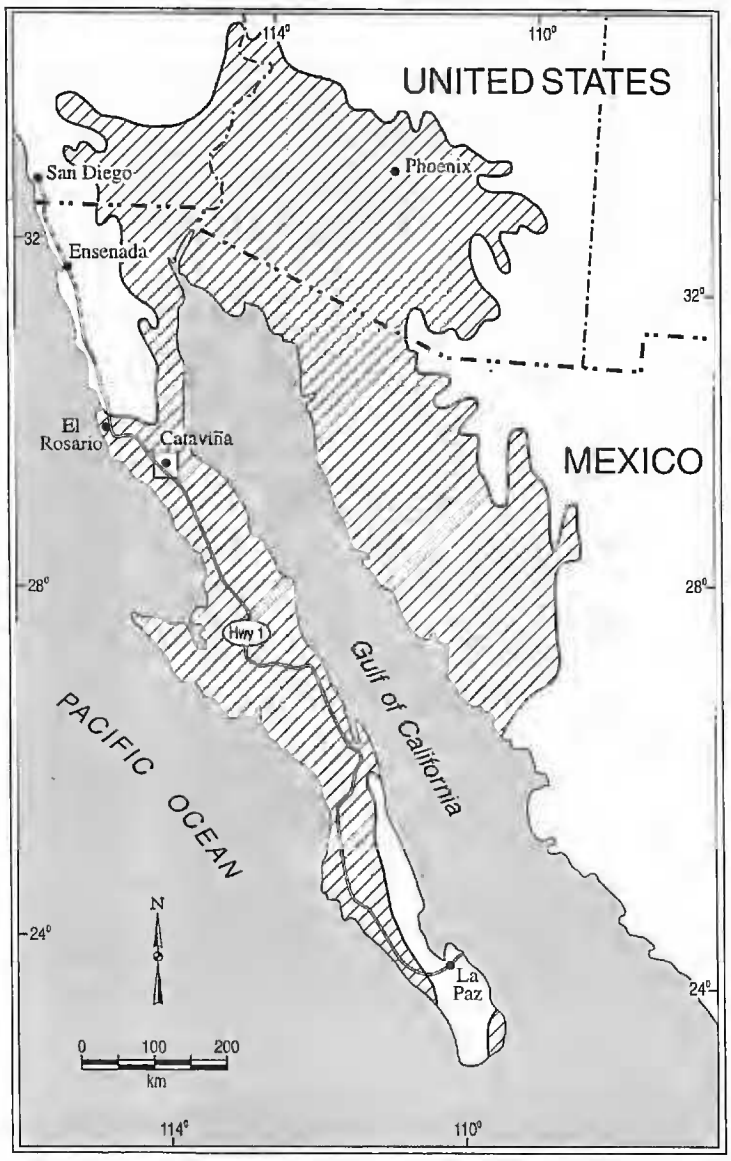

Figure 1. Map of the peninsula of Baja California, México, showing general location of the Cataviña region and an outline of the Sonoran Desert (cross hatched).

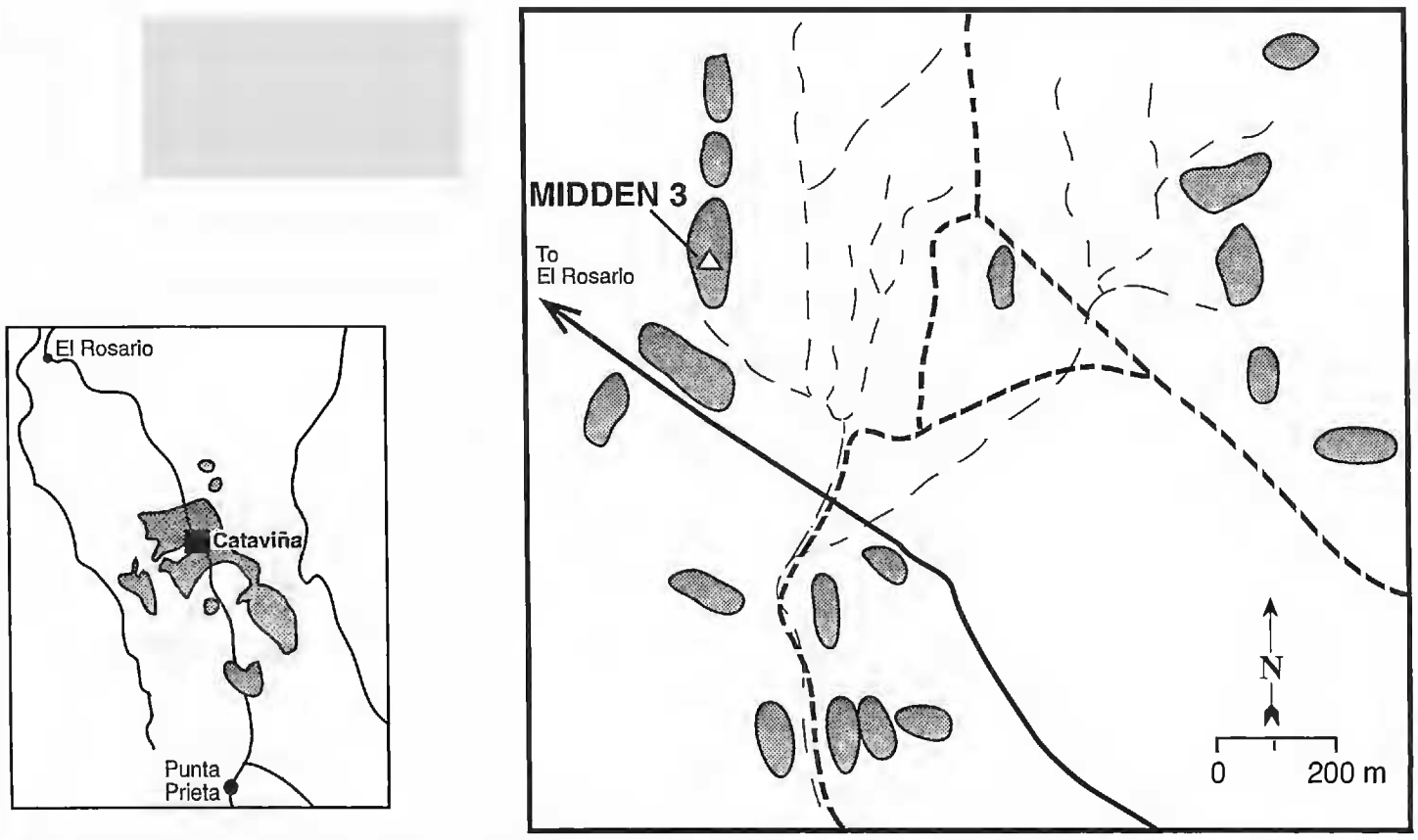

Figure 2. Map of the site showing the main areas of granite boulder outcrops (stipled) in the Central Desert, Baja California, México and the Cataviña site and the location of midden #3.

published data). Clark et al. (1993) reported 430 mm (16.9 in) of precipitation at this site from April 1985 through July 1991 for an average of about 61 mm per year. Mean summer temperatures are 25.8° C and mean winter temperatures are 13.2° C (n = 24 years) (García 1981). The above publications only list monthly averages of temperature. Through the use of maximum-minimum thermometers and individual observations during some winter months in some years Clark (unpublished data) has recorded freezing temperatures in this area. During the 1989–90 winter max-min thermometers in two different areas (one near granite boulders and one in the open) recorded lows of −3° C and −9° C, respectively.

The weathered Cretaceous granite rocks of the Jaraguay block (Gastil et al. 1975) form ideal areas for the preservation of water soluble middens. The midden (#3) reported here is located in a boulder pile approximately 10 m in elevation above the surrounding sandy wash (Fig. 3). The midden is wedged into a crack of large granitic rock, and is about 3 m below the top of the boulders (Fig. 4). The front of the midden is exposed to light from an opening in the boulders above but is protected from direct precipitation.

Midden.—The midden is 2 m in length and 1 m in width (Fig. 4). It is stratified, with the clearest stratification between the top 0.5 cm of unindurated, loose pale yellow plant material (subsample a) and the remaining 20–25 cm deep section of indurated, compacted, and stratified plant material. The radiocarbon date (Beta Analytic Inc. sample #30453) was obtained from a sample of *Neotoma* fecal pellets from the midden.

Material Examined.—A 652 g sample was soaked in distilled water for four days, until it was completely disaggregated. The arthropod and plant material was recovered after passing the liquid through a number 20 mesh (0.84 mm) soil sieve. After washing, 237 g of material remained (36.3%). The liquid was saved for pollen analysis (Sankey et al., unpublished data).

The dry material (237.0 g) remaining was separated into arthropods and vegetation under a dissecting microscope using low power. Individual arthropods and arthropod fragments were mounted on standard entomological card points with water soluble white glue (Borrer et al. 1989).

The arthropod material was then identified using entomological keys (Arnett 1985, Borrer et al. 1989) and by consulting specialists. Extant arthropods have been collected at this site since 1976 (Blom & Clark 1980, 1984, 1988; Hovore 1988; Papp 1989; Shook 1989; Leschen 1996; Triplehorn 1996) using pitfall traps (Clark & Blom 1992), mailaise traps, UV light traps, bait traps, pan traps, and a variety of hand collection techniques (Clark & Blom 1979, 1989, 1992) and these specimens were used to compare with the arthropod fragments found in the midden.

Voucher specimens of the arthropods, plants, and *Neotoma lepida* (vertebrate catalog numbers 46, 654, 655, and 656) are located in the Orma J. Smith Museum of Natural History, Albertson College of Idaho, Caldwell (ALBRCIDA).

Results and Discussion

The following is a description of the identified arthropod remains from the subsample (315 arthropod fragments) of this *Neotoma* midden (Table 1). Taxa identified are briefly described with their known occurrence in *Neotoma* middens, known present occurrence in the Cataviña area (taken from the literature and our museum collection), and a brief account of their ecological status.

Archnida: Chelonethida (Chernetidae)

Material.—Two palpal chelae. These are from two individuals, one adult and one a tritonymph.

Figure 3. Photographs of the Cataviña site boulder area containing midden #3: a) boulder area from a distance showing shrubs, including mesquite on the left in the sandy wash; b) close-up of the boulder area showing no mesquite in the boulders.

Figure 4. Photograph of the Cataviña site, midden #3 in a granite rock crack. The midden is approximately one meter in width and two meters in length. The edge of the midden is indicated by the white arrow.

Occurrence in Packrat Middens.—Pseudoscorpions have previously been reported from middens (Hall et al. 1989, 1990).

Occurrence in the Cataviña Area.—Several pseudoscorpions of the family Chernetidae have been collected at this site in pitfall traps and were also found to be phoretic on Cerambycidae (Coleoptera).

Discussion.—These were the only arachnids found in the midden. The chelae are very chitinous and might be the only parts of the pseudoscorpions to survive. Pseudoscorpions often live around rock cracks and in litter and other organic deposits (Weygoldt 1969, Muchmore 1990) and stored-food products (Olsen et al. 1996) thus find good habitat in *Neotoma* nests.

Insecta

The majority of the arthropods collected in this midden are insects and most of these insects are beetles (Coleoptera) (Table 1). The fact that Coleoptera form the majority of the assemblage is not surprising considering they are "hard-bodied" (Elias 1990).

Coleoptera, Anobiidae

Material.—This family is only represented by one fragment.

Occurrence in packrat middens.—Only one midden literature record could be found (Hall et al. 1990).

Table 1. Arthropods from 1770 B.P. *Neotoma* midden sample, Cataviña area, Baja California, México. *"Body, bodies" refer to head, thorax, and abdomen, usually with legs and antennae missing.

Taxa	Material	Number
Arachnida		
Chelonethida		
Chernetidae	pedipalpal chela	2
Diplopoda		
unidentified	segment	
Insecta		
Coleoptera		
Anobiidae	body fragment	
Bruchidae		
Algarobius prosopis (LeConte)	bodies*	2
	body fragments	31
Carabidae		
Harpalus sp.	elytra	
Lathridiidae		
Metophthalmus rudis Fall	body	
	body fragments	10
Ptinidae		
Niptus ventriculus LeConte	bodies, abdomens	5
Niptus sp.	bodies, abdomens	10
Ptinus verticalis (?)	bodies, abdomens	17
Tenebrionidae		
Blapstinus sp.	head	
unidentified	body fragments	2
unidentified Coleoptera	body fragments	57
Diptera		
Syrphidae (?)	puparium fragment	
Hemiptera		
unidentified	heads	2
Hymenoptera		
Apoidea	head	
Chalcidoidea		
Pteromalidae (?)	head	
Formicidae		
Ecitoninae		
Neivamyrmex nigrescens (Cresson)	head	
Myrmicinae		
Pheidole grallipes Wheeler	heads	3
Solenopsis xyloni McCook	gasters, heads, thoraces	60
unidentified Formicidae	heads, gasters, thoraces	26
unidentified Hymenoptera	head	7
Lepidoptera		
unidentified caterpillar	heads	4
unidentified insects	body fragments	68
Totals: Total taxa 23+	Total specimens	315

Occurrence in the Cataviña Area.—Anobiids are known to occur in this area and have been collected, but have not yet been determined to species.

Discussion.—Anobiids live in dry plant materials (Arnett 1985, Borror et al. 1989) and could thus be expected to be found in a *Neotoma* den. They are also found in stored food products (Madenjian 1996).

Coleoptera, Bruchidae, *Algarobius prosopis* (LeConte)

Material.—Thirty three bodies and body fragments (Fig. 5a).

Occurrence in Packrat Middens.—Literature records for Bruchidae in *Neotoma* middens include Hall et al. (1989, 1990) and Elias & Van Devender (1990). *Algarobius prosopis* was one of the bruchids reported by Hall et al. (1989).

Occurrence in the Cataviña Area.—Modern Bruchidae recorded for this site include *A. prosopis* and *Mimosestes protractus* (Horn). *Algarobius prosopis* occurs in Texas, Arizona, and in México: Sonora, Sinaloa, Chihuahua and Baja California (Kingsolver 1986). Kingsolver (1986) notes that this beetle is the most common *Prosopis* bruchid in its range, but does not show it as known from the Central Desert area.

Discussion.—The dominant identifiable beetle in the midden is the mesquite beetle *A. prosopis* (Table 1, Fig. 5a). The Bruchidae or seed beetles are common in plant seeds especially those of leguminous species (Arnett 1985, Borror et al. 1989). *Algarobius prosopis* is a common seed predator of *P. glandulosa* Torrey (Kingsolver et al. 1977, Kingsolver 1986). Because *Prosopis glandulosa* is the dominant plant found in the midden (Sankey et al. unpublished data) the beetles were probably transported into the den by *Neotoma* carrying in the mesquite. Bruchids are found in stored food products (Madenjian 1996).

Coleoptera, Carabidae cf. *Harpalus*

Material.—One elytron (Fig. 5b).

Occurrence in Packrat Middens.—Carabids have been reported from middens (Elias 1987; Elias & Van Devender 1990; Hall et al. 1989, 1990).

Occurrence in the Cataviña Area.—Many species of Carabidae have been collected and identified at this site, but *Harpalus* sp. has not been among them to date.

Discussion.—The ground beetles are the third largest family of beetles and are common in debris, under objects and on the ground surface (Arnett 1985, Borror et al. 1989). Carabids are rarely found in stored food products (Madenjian 1996).

Coleoptera, Lathridiidae, *Metophthalmus rudis* Fall

Material.—One body (head, thorax, abdomen) (Fig. 5c).

Occurrence in Packrat Middens.—Lathridiidae have been reported from middens (Elias & Van Devender 1990, Van Devender & Hall 1994). *Metophthalmus rudis* has not previously been reported from midden habitats.

Occurrence in the Cataviña Area.—Modern species of Latharidiidae collected at this site include *Corticarina scissa* (LeConte), *Dienerella ruthae* Andrews, *M. rudius*, and *Metophthalmus trux* Fall.

Discussion.—The family consists of minute beetles which inhabit moldy ma-

terials and debris (Arnett 1985, Borror et al. 1989). *Metophthalmus* live in ground litter and feed on fungi (Andrews 1976). *M. rudis* has been reported from recent *Neotoma* nests in a variety of locations in the coastal area of Central California (Andrews 1976). Lathridiids are commonly found in stored food products (Madenjian 1996).

Coleoptera, Ptinidae, *Niptus ventriculus* LeConte and *Ptinus verticalis* LeConte

Material.—Five bodies and abdomens of *N. ventriculus* 17 bodies and abdomens of *P. verticalis* (Fig. 5d).

Occurrence in Packrat Middens.—Ptinidae are common in midden samples (Elias 1987; Hall et al. 1989, 1990).

Occurrence in the Cataviña Area.—Ptinidae are common at this site and are commonly caught in pitfall traps, but have not yet been identified to species. *Ptinus verticalis* is known only from southern California (Papp & Okumura 1959, Papp 1962). *Niptus ventriculus* is known from Texas to California south through Mexico (Papp & Okumura 1959, Papp 1962) and Baja California, including the Central Desert (Aalbu & Andrews 1992).

Discussion.—The family Ptinidae live in dried plant and animal material and in animal nests (Arnett 1985, Borror et al. 1989). *N. ventriculus* is known from *Neotoma* nests and *N. arcanus* feeds on *Neotoma* pellets (Aalbu & Andrews 1992). Ptinids are common in stored food products (Madenjian 1996).

Coleoptera, Tenebrionidae, *Blapstinus*

Material.—One head.

Occurrence in Packrat Middens.—Tenebrionidae are also common in midden samples (Elias 1987; Elias & Van Devender 1990; Hall et al. 1989, 1990), and *Blapstinus* has previously been reported from packrat midden samples from Sonora (Hall et al. 1988).

Occurrence in the Cataviña Area.—Blapstinus histricus Casey occurs at the site and Blaisdell (1943) lists an additional seven species of *Blapstinus* from Baja California.

Discussion.—Tenebrionidae generally feed on plant materials of some sort (Borror et al. 1989). The family Tenebrionidae are richly represented in stored food products (Madenjian 1996).

Diptera, Syrphidae

Material.—One puparium fragment.

Occurrence in Packrat Middens.—Syrphidae have not been reported from midden samples although Stratiomyidae are known from such samples (Hall et al. 1989, 1990).

Occurrence in the Cataviña Area.—Few of the Syrphidae collected at this site have been identified but we have found *Volucella isabellina* Williston.

Discussion.—The family contains many species and may be found in a wide variety of habitats including decaying vegetation (Arnett 1985, Borror et al. 1989). These flies are found in stored food products (Olsen 1996a).

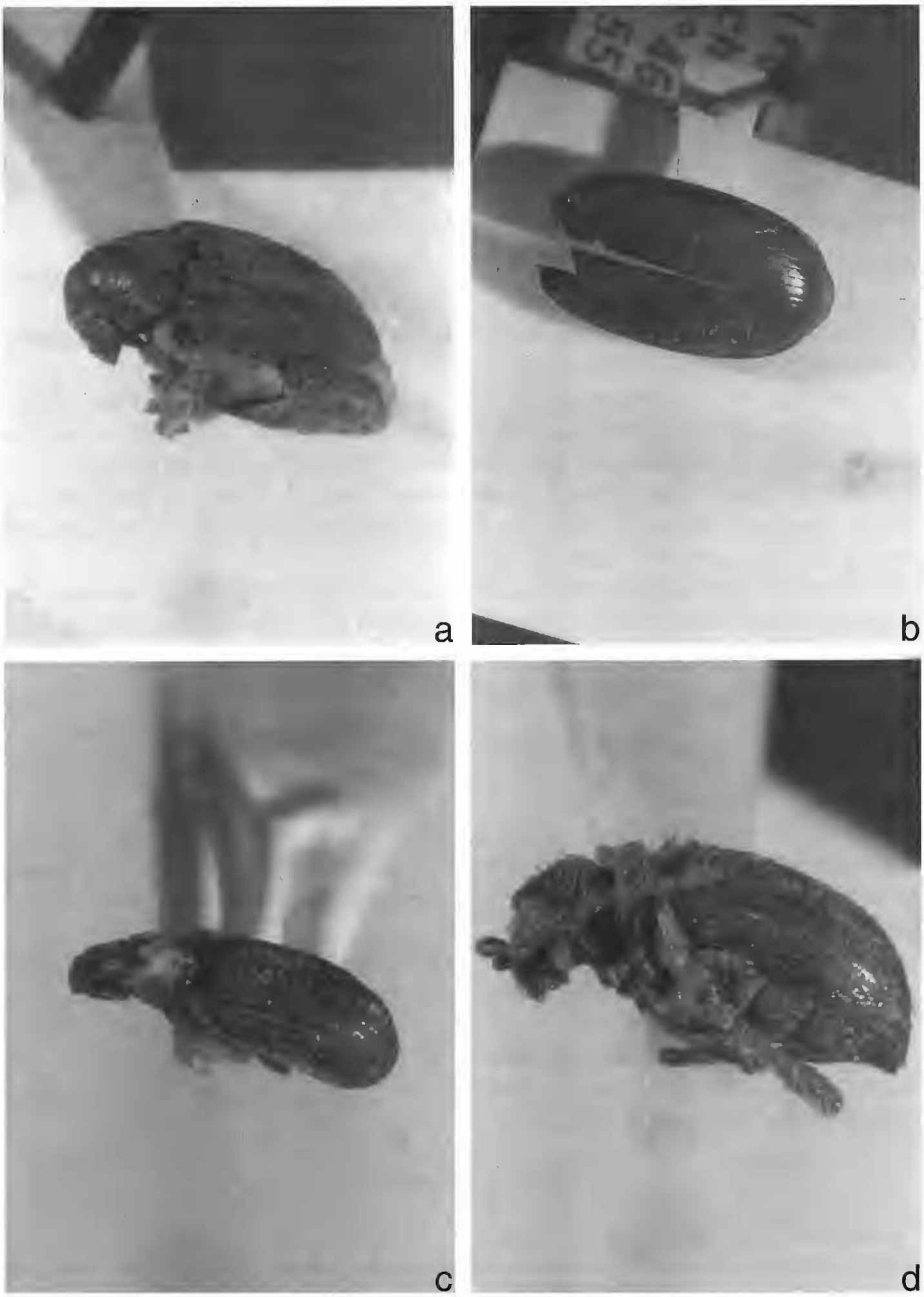

Figure 5. Photographs of selected arthropods from the Baja California, México, Central Desert, Cataviña site, midden #3. a) Coleoptera, Bruchidae, *Algarobius prosopis* (LeConte), entire beetle. Scale: length is 3.5 mm. b) Coleoptera, Carabidae, cf. *Harpalus*, elytra. Scale: length is 8 mm. c) Coleoptera, Lathridiidae, *Metophthalmus rudis* Fall, entire beetle. Scale: Length is 1.25 mm. d) Coleoptera, Ptinidae, *Ptinus verticalis* LeConte, entire beetle. Scale: Length is 3 mm.

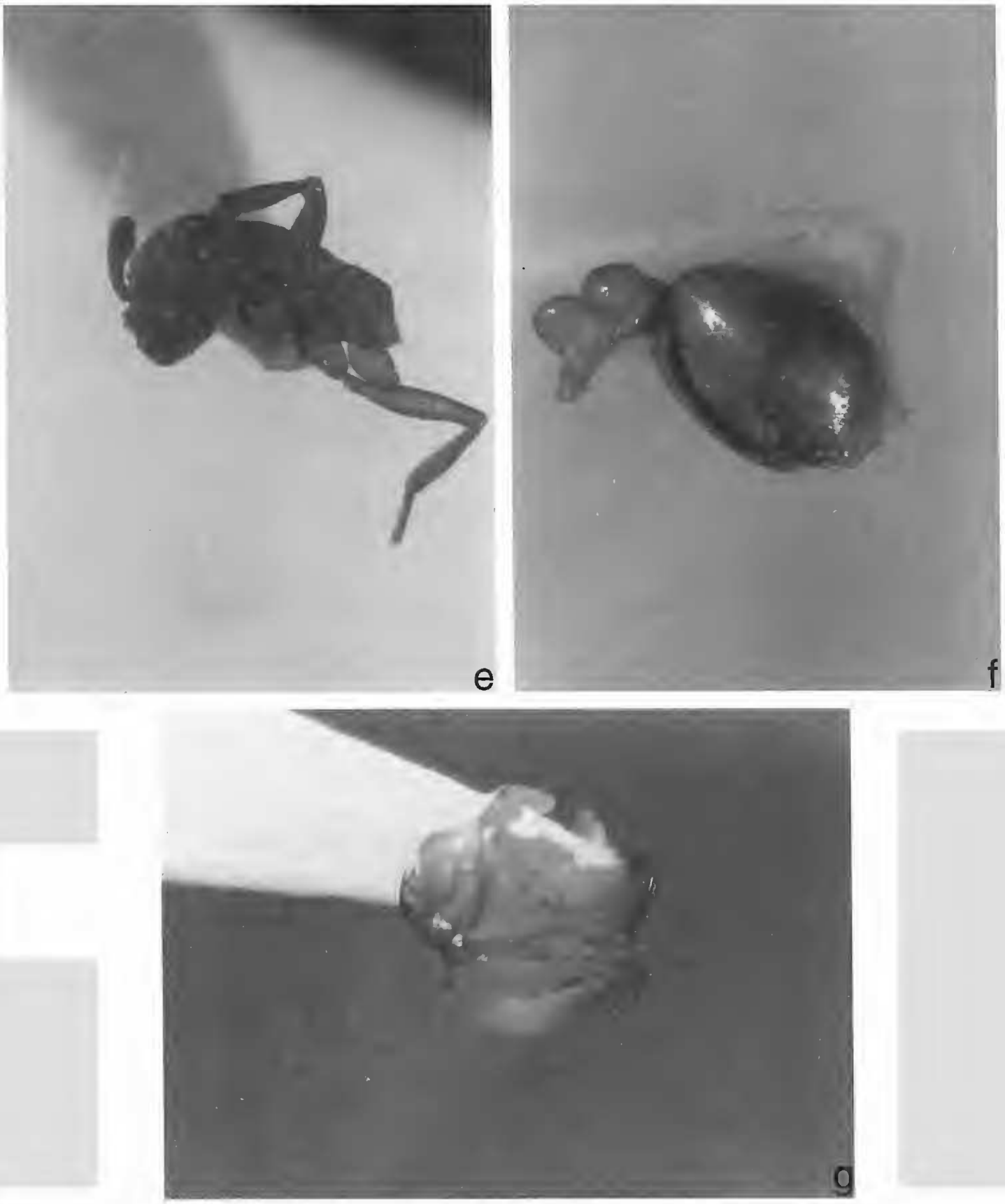

Figure 5. (Continued.) e) Hymenoptera, Formicidae, *Neivamyrmex nigrescens* (Cresson), head and thorax. Scale: Length is 1.5 mm. f) Hymenoptera, Formicidae, *Solenopsis xyloni* McCook, petiole, postpetiole, and gaster. Scale: Length is 1 mm. g) Lepidoptera, unidentified caterpillar, head Scale: Length is 2 mm.

Hemiptera

Material.—Two unidentified heads.

Occurrence in Packrat Middens.—Hemiptera have been reported previously from middens (Elias 1987, Hall et al. 1989, 1990).

Occurrence in the Cataviña Area.—Many species of Hemiptera are found at this site today.

Discussion.—Hemiptera are plant feeders and are very common on vegetation (Arnett 1985, Borror et al. 1989).

Hymenoptera, Apoidea

Material.—One head.

Occurrence in Packrat Middens.—Apoidea have not previously been reported from packrat middens.

Occurrence in the Cataviña Area.—There are such a variety of species of bees known from the site that not much can be interpreted by its presence.

Discussion.—Bees are common on flowers where they feed on nectar and act as pollinators (Arnett 1985, Borror et al. 1989).

Hymenoptera, Pteromalidae

Material.—One head.

Occurrence in Packrat Middens.—The family has not previously been reported from packrat middens.

Occurrence in the Cataviña Area.—Pteromalidae have been collected in the area but remain unidentified.

Discussion.—Pteromalidae are a large family of parasitic wasps (Arnett 1985, Borror et al. 1989), which parasitize a large variety of insect groups and may have entered the midden within another insect. They are known to parasitize insects found in stored food products (Avaritt & Richter 1996).

Hymenoptera, unidentified Formicidae

Material.—Twenty six heads, gasters, and thoraces.

Occurrence in Packrat Middens.—Ants are a common component of midden faunas (Elias 1987; Hall et al. 1989, 1990).

Occurrence in the Cataviña Area.—Clark (1980) reported 25 species of ants from this area representing four subfamilies: Ecitoninae, Pseudomyrmecinae, Myrmicinae, and Formicinae.

Discussion.—Ants made up the second most abundant group found in the midden (Table 1). The vast majority of identifiable Hymenoptera from the midden are ants. Avaritt and Richter (1996) report ants from stored food products.

Hymenoptera, Formicidae, Ecitoninae, *Neivamyrmex nigrescens* (Cresson)

Material.—One head and thorax (Fig. 5e).

Occurrence in Packrat Middens.—The species has been reported from packrat midden samples twice (Hall et al. 1989, 1990).

Occurrence in the Cataviña Area.—This species occurs at the site (Clark & Blom 1988). Watkins (1982) records four species of *Neivamyrmex* for the state of Baja California Norte, including *N. nigrescens*.

Discussion.—The ant forages for insect prey (mostly ant brood) at night and may have strayed into the packrat den.

Hymenoptera, Formicidae, Myrmicinae, *Pheidole grallipes* Wheeler

Material.—Three heads.

Occurrence in Packrat Middens.—*Pheidole* has been reported previously from midden collections (Elias 1987; Hall et al. 1989, 1990).

Occurrence in the Cataviña Area.—*Pheidole grallipes* is known from this area.

Discussion.—*Pheidole grallipes* inhabits granitic crevices at this site (Clark et al. 1986) and is one of four species of this seed harvesting genus to be found here (Blom & Clark 1980, Clark, unpublished data). It also appears to feed on other arthropods (Clark et al. 1986). *Pheidole* is a very large genus of mostly tropical species (Naves 1985). There are no fossil *Pheidole* known previous to the Miocene (Brown 1973).

Hymenoptera, Formicidae, Myrmicinae, *Solenopsis xyloni* McCook

Material.—Sixty gasters (Fig. 5f), heads, and thoraces.

Occurrence in Packrat middens.—The *Solenopsis aurea* Wheeler has been reported from middens (Hall et al. 1989, 1990).

Occurrence in the Cataviña Area.—*Solenopsis xyloni* is the only species of the genus found at the site now (Blom & Clark 1980).

Discussion.—This is the native fire ant and it feeds primarily on other insects in this area (Clark 1980). Much literature is available on the genus (Rhoades 1977, Lofgren & Vander Meer 1986, for example).

Lepidoptera

Material.—Four heads (Fig. 5g).

Occurrence in Packrat Middens.—Lepidoptera have only been reported once in the midden literature (Hall et al. 1990). Caterpillars are very soft-bodied and would not preserve well as entire specimens in the midden environment (Elias 1990).

Occurrence in the Cataviña Area.—Lepidoptera are common in the area. Many species of butterflies and moths have been collected (Clark unpublished data, Brown et al. 1992).

Discussion.—Lepidoptera caterpillars feed on a large variety of plant material (Arnett 1985, Borror et al. 1989) and these specimens were probably brought into the midden on vegetation carried by a packrat. They are also found in stored food products (Olsen 1996b).

A significant portion (68 specimens) of the arthropod fragments found in the midden have not been identified because they are either too fragmentary or are not parts useful for identification (Table 1). In addition, there are many soft-bodied arthropods (including parasites of *Neotoma*) that probably inhabited the packrat den area that have not been preserved in this midden sample (Baird & Graham 1973). Elias (1990), Van Devender & Hall (1994) provide nice discussions of some of the problems with the taphonomy of arthropods in middens.

From this evidence we can not see a major difference between the late Holocene and recent arthropod assemblages of the Cataviña area. However a study of the midden plants has revealed that the modern vegetation and climate are drier than ~1770 years ago (Sankey et al., unpublished data).

Conclusions

1) This is the first record of Holocene arthropods from a *Neotoma* midden in Baja California. Study of this and other middens in the area will further paleoenvironmental reconstructions for the Central Desert area during the Holocene.

2) This Holocene (1770 radiocarbon years B.P.) *Neotoma* midden contains 23+ taxa from a subsample of 315 arthropod specimens. Ten of these taxa are reported from *Neotoma* midden assemblages for the first time. Most of these are common at the site today.

3) The most common arthropods are Coleoptera, especially the mesquite beetle, *A. prosopis*, and the mymicine ant, *S. xyloni.*

4) There is a close similarity between the arthropod and plant taxa from the midden and those living in the area today. From this evidence we can not see a major difference between the late Holocene and recent arthropod assemblages of the Cataviña area. However a study of the midden plants has revealed that the modern vegetation and climate are drier than ~1770 years ago.

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